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ALDRIN AND DIELDRIN

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SHELL CHEMICALS DISTRIBUTING COMPANY OF AFRICA LIMITED

ALDRIN AND DIELDRIN

PART I - GENERAL INFORMATION

1.1 The Products and their Properties:

Aldrin and dieldrin are coined common names given to two new chlorinated naphthalene insecticides. Aldrin (1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro-1,4,5,8-dimethanonaphthalene) is derived from dicyclopentadiene (a product of the petroleum chemicals industry) and is manufactured in the form of a solution containing 60% of technical aldrin. From this solution solid technical aldrin is prepared, and the commercial specification for the product is:-

Hexachloro Hexahydro Dimethano Naphthalene:	95% by wt.
Related Compounds:	5% " "

1.11 Dieldrin is prepared from aldrin by an oxidation process which yields the chemical 1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4,5,8-dimethanonaphthalene. The commercial specification, accepted by the World Health Organisation, is:-

Hexachloro Expoxy Octahydro Dimethano Naphthalene:	85% by wt.
Related Compounds:	15% " "

1.12 The specifications for aldrin and dieldrin given above have been accepted by the Inter-departmental Committee on Pest Control of the United States Department of Agriculture.

1.2 Pure Compounds:

Aldrin (recrystallised) and dieldrin (recrystallised) are defined as referring to products containing not less than 99% of the chemical compounds named above.

1.3 /.... Page 2/....

1.3 Alkali Resistance:

Aldrin and dieldrin, and formulations of these insecticides, are, unlike other chlorinated hydrocarbons, stable in the presence of alkalis. The instability of the commonly used chlorinated hydrocarbons in contact with, for instance, lime, and the consequent deterioration of biological activity is a serious practical disadvantage. Aldrin and dieldrin, on the other hand, are completely impervious to the action of alkaline reagents and, under conditions of practical use, are unaffected by acidic reagents.

1.4 Lack of Tainting Drawback:

Neither aldrin nor dieldrin has caused tainting in root crops grown in soil to which these chemicals have been applied. Among the crops tested in this respect are potatoes, turnips, carrots, onions. Furthermore, neither of the insecticides are translocated by plants, and thus there is no deposition of harmful quantities of these substances in plant tissue.

1.5 Aldrin and Dieldrin Harmless to Soil Micro-organisms:

At the doses recommended for the control of soil pests, neither aldrin nor dieldrin show harmful effects on micro-organisms found in the soil. Tests are proceeding to determine the dose level at which such organisms are harmed: the indications are that this level will be far above the dose level required for practical insect control.

1.6 Phytotoxicity:

Both aldrin and dieldrin applied as commercial sprays have controlled insects without, in any way, damaging crops. Experiments carried out in South Africa have shown that neither aldrin nor dieldrin, in wettable powder or emulsion form, will affect the germination of maize seeds, and there is a large body of evidence from overseas usage to show that, unlike other chlorinated hydrocarbon insecticides, the new compounds are not injurious to any farm or garden crops, including Cucurbits.

1.7 /.... Page 3/....

1.7 Literature:

The information given in the following sections is condensed and general in nature. Authorities and scientific workers who are interested in particular aspects are invited to write for copies of technical papers and reports.

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PART II - TECHNICAL

2.1 Solubility in Common Solvents:

	Grams per 100 ml. of Solvent: ALDRIN.		DIELDRIN.
Acetone	109		26
Benzol	183		56
Ethyl Alcohol	5		4
Kerosine (deodorised)	28		5
High Aromatic Spirit	-		25
Diesel Fuel	30		17
Toluol	267		54
Turpentine (vegetable)	127		17
Xylol	235		52
Water	-	Insoluble	-

2.2 Formulations Available:

In addition to the technical commercial grades, limited supplies of aldrin and dieldrin are available in South and East Africa in the following formulations:-

Aldrin	60	(60% aldrin by wt.)
Aldrin	60	(emulsifiable).
Aldrex	2	(emulsifiable concentrate containing 2 lbs. of aldrin technical per U.S. gallon - 23.10%).
Aldrin	40%	Wettable Powder.
Dieldrex	15	(emulsifiable concentrate containing 1½ lbs. of dieldrin technical per U.S. gallon - 18.62%).
Dieldrin	50%	Wettable Powder.

2.3 /.... Page 5/....

2.3 Formulation:

It will be noted that some formulations, notably low percentage active material dusts, are omitted from the list given in 2.2. Such dusts can be formulated fairly easily by dilution of the wettable powder, and it is hoped that, in the near future, local preparations of these formulations will be possible, using imported technical material and locally obtainable carriers.

2.4 Compatibility:

Aldrin and dieldrin are compatible with all commonly used insecticides and fungicides.

ALDRIN AND DIELDRIN

PART III - GENERAL ENTOMOLOGICAL REPORT

3.1 Of the two insecticides, aldrin generally exhibits a short effective life when exposed to light and air; dieldrin, on the other hand, gives a long residual effect in most exposures, longer in several cases than DDT. Both insecticides have been shown to be particularly effective for the control of Diptera (adult and larval stages), Coleoptera (adult and larval stages), Isoptera, Thysanoptera, and Hymenoptera. Generally speaking, the insecticides are not particularly effective against Lepidopterous larvae, Neuroptera and Homoptera. This is, of course, a very broad classification, and there are specific insects falling within these orders which exhibit specific reactions to the insecticides.

3.2 Aldrin and dieldrin were first developed in the United States of America, and it is natural that development there should be more advanced than in Southern Africa. Details of recommendations for the control of pests in South Africa, Rhodesia and East Africa, will be given later, but, in the meantime, the following information will be of interest:

3.21 Federal (U.S.A.) Registration has been granted for the following applications:-

ALDRIN:

Cotton Boll Weevil,	Thrips (cotton),
Lygus,	Ants,
Plant bugs,	White grubs,
Grasshoppers,	Wireworms.

DIELDRIN:

Cotton Boll Weevil,	Red Harvester Ant,
Cutworms (cotton),	Lucerne Weevil (adult),
Lygus,	Thrips (Gladiolus).
Thrips (cotton),	-

3.22 /.... Page 7/....

3.22 Federal Registration is pending for the following applications:-

ALDRIN:

Mosquitos (larvae),
Cutworms,
Mole crickets.

DIELDRIN:

Thrips (citrus),
Cutworms,
Flies: (house, larvae and adult spraying - out of doors, adult strip treatment - indoors),
Plum curculio,
Soil insects (corn beetles, cutworms, etc.)

3.23 Aldrin has been shown to be one of the most effective and economic insecticides so far used for the control of the desert locust (Schistocerca gregaria) in the Middle East, and the same insecticide has given outstanding results in Canada and the United States of America as a control for grasshoppers. In the United States of America, more than 10 million acres have now been cleared of grasshoppers by the use of aldrin.

3.24 It will be apparent from the information given in Part I (1.3 to 1.6) that aldrin and dieldrin give promise of being most effective for the control of a large number of soil inhabiting insects. This promise is being fulfilled. Aldrin and dieldrin not only control those insects which, in various stages, feed directly on seeds and roots: they are also effective against the dormant or non-injurious stages of free living foliage and fruit feeders which spend part of their life-cycle in the soil.

3.25 Aldrin will probably, on economic grounds, become the more important insecticide for soil application, and practical trials with this material are under way or planned against a large number of insects.

ALDRIN AND DIELDRIN

PART IV - ENTOMOLOGICAL REPORT:

SOUTH AND EAST AFRICA.

4.1 Tests with aldrin and dieldrin in South and East Africa have confirmed, to a considerable extent, the indications given in 3.1. Neither insecticide has shown promise of giving economic control of:

Cotton Boll Worm	-	Heliothus obsoleta, Earias insulana, Diparopsis castenea, etc.
Bagrada Bug	-	(Bagrada hilaris)
Codling moth	-	(Enarmonia pomonella)
False Codling moth	-	(Argyoploce Leucotreta)
Cabbage Caterpillar	-	(Plutella maculipennis)
Lucerne Caterpillar	-	(Colias electo)
Maize Stalk Borer	-	(Busseola fusca)

4.2 Although both aldrin and dieldrin are effective when used as mosquito larvaecides, the dosage rate is not sufficiently low to warrant a specific recommendation. Similarly, in the case of the brown locust (L. pardalina), aldrin is not indicated.

4.3 Promising results have been obtained with aldrin and dieldrin in the following applications:-

4.31 /.... Page 9/....

4.31 Cattle Ticks: (Hyolamma spp., Rhipicephalus spp.)

Preliminary tests appear to indicate that dieldrin is effective against a large range of cattle ticks at an extremely low dose. This work is being carried on, and it is hoped that it will be possible to make specific recommendations in the not too distant future.

4.32 Termites: (Hodotermes, Termes, Cryptotermes spp.)

The indications here are that dieldrin may become an outstanding insecticide for the control of termites, but a considerable amount of applicational development work needs to be carried out before any specific recommendations can be made.

4.33 Fruitfly: (Ceratitis capitata, Dacus spp.)

In accordance with the general indication mentioned in 3.1, aldrin and dieldrin have given encouraging results as insecticides for the control of Fruitfly of various species. Dieldrin is the more promising, and experiments are being carried out to determine the effective dosage and the best method of application in South and East Africa.

This is of particular interest, in view of the damage caused to Cucurbits by the Melon Fly.

4.34 SOIL PESTS:

Cutworm	-	(Agrotis spp.)
Tassel Beetle Larvae	-	(Astylus atromaculatus (Larvae)
Black Maize Beetle	-	(Heteronychus sanctae helenae)
Sandveld Grain Beetle	-	(Apophylia duviverei)

etc.

Field scale experiments are in progress in various parts of South and East Africa with aldrin and dieldrin as insecticides for the control of soil pests. The indications, so far, are that both insecticides are very effective, and that, contrary to what might be expected, aldrin persists in soil for a considerable time. An information sheet, giving details of application, will be issued as soon as tests are completed.

4.35 /.... Page 10/....

4.35 Maize Tassel Beetle: (Astylus atromaculatus).

Effective and economic control with dieldrin as a low active material dust is indicated, but local trials have still to be completed before any specific recommendation can be made.

4.36 Potato Tuber Moth: (Phthorimaea operculella).

In view of the absence of the danger of tainting when aldrin and dieldrin are used in soil, the trials now being initiated with dieldrin, as a means of control of the Potato Tuber moth, are of considerable importance. The results of these trials will not be available for some months to come.

4.37 Citrus, Onion and Gladioli Thrips: (Scirtothrips aurantii, Thrips tabacci).

The experiments carried out in the United States of America have not yet been repeated in South and East Africa, but it is fairly certain that the Thrips tabacci will be effectively controlled with dieldrin. Specific recommendations will be made as soon as tests have shown that this is the case.

4.4 SPECIFIC RECOMMENDATIONS FOR ALDRIN AND DIELDRIN:

So far, tests carried out in Southern and East Africa, have shown aldrin or dieldrin to be outstanding in three specific applications. Application methods, dosage rates, etc., are given in detail in information sheets shortly to be published, but the following descriptive outlines will, no doubt, prove of interest:-

4.41 Treebanding with Dieldrex 15:

Wherever mealybug (Pseudococcus spp.) exists, together with protective ants (Iridomyrmex spp.; Pheidole spp.) control has presented considerable difficulties. Many insecticides hitherto used have the disadvantage that, besides reducing the mealybug population, natural predators and parasites (Vedelia spp.; Anagyrus spp.; Hyperaspis spp., etc.) of these pests are also killed. The result is that, unless continual applications of insecticides are made, the mealybug, which normally breeds more quickly than its enemies, re-establishes itself from small residual populations in a very short time.

4.42 /.... Page 11/....

4.42 Dieldrin has been proved to be most effective against ants of many species, and tests carried out in East Africa and South Africa, have shown that, in addition to this, dieldrin exhibits repellent properties. The old-fashioned treebands, while effective for a short while, need frequent renewing and are troublesome to put on, and barriers of many different types of insecticides, while they may kill the ant eventually, do not prevent it first carrying out its function of nurturing the mealybug. The remarkable results obtained with dieldrin have been achieved without necessarily killing any ants. The treeband prevents crossing altogether, and, consequently, the mealybug, deprived of its protective custodian ant, soon succumbs to the attack of wasp and ladybird parasites and predators.

4.43 Dieldrin, therefore, in the form of Dieldrex 15, which has been found to be the most effective formulation, offers a really effective ant barrier material, and what is more important, it has been proved to be effective, even under the most adverse weather conditions, for a period of at least 4 months. In this time, it has been found that severe infestations of mealybug have been eliminated by natural enemies.

4.44 The application of Dieldrex 15 is very simple. The emulsion is merely broken down at the ratio of one gallon to nine gallons of water, and the ready for use mixture is applied by means of a small sprayer or a paint brush, at the rate of about 2 fl. ozs. per tree, over a width of 6 inches to 10 inches. An alternative method of control, by which a much more dilute emulsion is sprayed on the soil around the tree and applied to the trunk to the point of run-off, is being tested, but the comparatively high strength spray band has been proved, and it is doubtful whether the results can be improved upon.

4.45 The cost of protection from ants works out to between one penny and 1½d per tree. Even allowing minimum protection for three months, 4 applications would cost only 6d per tree, at the maximum. Protection is not always needed throughout the year, however, and properly timed, two applications will probably be found to be most effective.

4.46 Full details of the spray band technique, using Dieldrex 15, for mealybug control in coffee shambas and vineyards, together with information on the control of soft scale in citrus orchards, where the ant complex exists, will be published shortly.

4.5 /.... Page 12/....

4.5 Adult Mosquito Control:

Experiments carried out, under the auspices of the Colonial Insecticide Research Committee in Kenya, with dieldrin as an insecticide for the control of adult mosquitos (A. gambiae and A. funestus) have given outstanding results. Details are available to interested authorities, but the ~~following~~ general recommendation, based on the results of experiments carried out to date, is as follows:-

4.51 25 Grams per square metre, or approximately 25 mgms. per square foot of dieldrin, applied as a 0.625% suspension of the insecticide to the point of run-off, gives effective control of adult mosquitos for a period of at least six months. This period is stated conservatively and, in the majority of cases, dieldrin has proved to give a sufficiently high kill for a period of nine months. An additional factor of great importance is that, as indicated in 1.3, dieldrin is resistant to alkalis, and, consequently, functions as well on lime-washed walls as on other interior surfaces.

4.52 The 50% wettable powder has been found to be the most effective formulation, no doubt due to less absorption when compared with the emulsified solution.

4.53 A further point of interest is that, at the dosage rate recommended, dieldrin is not more toxic to operators than a 5% DDT. solution or suspension. (5.24).

4.6 Blowfly Control: (Lucilia cuprina)

Experiments carried out by the Veterinary Research Institute at Onderstepoort, which will be published shortly in a paper by Dr. R. du Toit and Dr. O. Fiedler, have shown that aldrin is an outstanding insecticide for the control of Blowfly strike. The application of a 0.5% active material suspension of the wettable powder to the parts normally attractive to Blowfly, has given 100% control of hatching larvae for a period of at least 32 weeks. Unlike other insecticides, aldrin does not merely remain on the outer portions of the growing wool, but is absorbed into the fibre, and, so to speak, translocated to skin level. As the new wool grows out, sufficient aldrin remains in the fibre, effectively to control larvae hatching from eggs laid.

4.61 Field trials have still to be carried out before it is possible to give recommendations for application. These trials are under way, and it is hoped that, in the near future, specific details can be given in the form of an information sheet.

ALDRIN AND DIELDRIN

PART V - TOXICITY

5.1 Toxicity of aldrin and dieldrin:

Chlorinated hydrocarbon insecticides, as a class, are known to be poisonous to varying degrees, and aldrin and dieldrin are no exceptions. When they first began to be used, precautionary warnings were issued. However, the data obtained during three years of investigations has shown that the toxicity hazard is far less than was at first thought. Moreover, the earlier statement that the dermal toxicity of aldrin and dieldrin was greater than the oral toxicity, has been shown to be completely unfounded.

5.2 Human Toxicity:

The acute toxicity for humans is unknown, but one case is known where the patient survived after the ingestion of six ounces of 1% aldrin emulsion. This patient showed no residual effects after recovery. Many other known cases of exposure to unknown, but smaller, amounts of aldrin have resulted in illnesses of less than 48 hours duration without sequelae.

5.21 Field exposures, under ordinary conditions of use, have not produced any known cases of chronic intoxication. These exposures have taken place under conditions of both hand and airplane spraying and dusting.

5.22 Studies of workmen who were exposed to these compounds for periods up to three years, have revealed no deleterious effects from exposures in excess of 5 mgm. of these chlorinated hydrocarbons per cubic metre of air. In addition to inhalation, an unknown, but considerable, amount of skin contact occurred. Neurological and laboratory examinations which included liver and kidney function tests were entirely negative. Under ordinary conditions of use it can be anticipated that the aforementioned exposures will not be attained.

5.23 /.... Page 14/....

5.23 These compounds may be absorbed either by oral ingestion, inhalation or, to a lesser extent, by skin contact. It is, therefore, desirable that excess exposures be prevented, and, whenever accidental oral ingestion has occurred, that the individual be seen by a physician. Whenever these substances have come into contact with the skin, contaminated clothing should be removed and the area washed with soap and water.

5.24 From the considerable amount of practical experience gained with dieldrin, which is the more toxic of the two insecticides, it is believed that the toxicity to humans of a 0.625% dieldrin solution or suspension (the recommended dose for adult mosquito control) is no greater than the toxicity of a 5% DDT. solution or suspension, as commonly used for this purpose and for other applications.

5.25 A further point of considerable significance is that early symptoms of intoxication with aldrin or dieldrin become apparent in humans over-exposed to these insecticides. This means that, in the event of accidental intoxication, early steps can be taken to treat the poisoning, and to remove the patient before there is any possibility of serious danger.

5.26 The recommendation for the treatment of accidental poisoning with either aldrin or dieldrin is to administer an emetic and to keep the patient prone and quiet. This applies particularly to oral ingestion of the chemicals. If the skin is contacted with one of the highly concentrated formulations, immediate washing with soap and water will prevent any absorption. Physicians may note that, in the case of accidental poisoning, Barbiturates should be administered as for anti-convulsion therapy, the patient being observed periodically.

5.3 Toxicity to Animals:

It has been shown, in animals, that delayed effects of dieldrin poisoning may occur as long as four days after oral ingestion. It has also been demonstrated, however, that symptoms of poisoning occur long before death can be anticipated, and that even advanced symptoms of poisoning are compatible with life, with or without treatment. Symptoms may recur after apparent recovery, but this is true only with high dosages.

5.31 /.... Page 15/....

5.31 With small doses, liver changes have been produced only in rodents. These changes have been similar to those produced by smaller doses of DDT. Therefore, it seems reasonable to believe that in low doses, these materials are less toxic to rats than is DDT.

5.32 There is evidence to show that, when these substances are applied to the skin in the same form as they are ingested, dermal toxicity is less than toxicity by oral ingestion.

5.33 The quantities of aldrin and dieldrin applied to animals, in practice, is normally far below the dose which would induce symptoms of poisoning, and investigational work now in progress has shown that repeated applications of effective insecticide doses are without harm to, so far, cattle and sheep. Experimental work with other animals, both farm and domestic, and birds, is not yet complete.

5.4 GENERAL:

Although, as indicated in 5.24, ready for use solutions and suspensions of aldrin and dieldrin, and also low concentration dusts, are relatively harmless to human beings when used as directed, it must be borne in mind that aldrin and dieldrin technical, and highly concentrated emulsions are not harmless, and that reasonable precautions must be taken to prevent untoward accidents.

5.41 Although millions of pounds of aldrin and dieldrin have been formulated without accidents, it is necessary to prevent excess exposure, and formulators should consult with us on this point.

ALDRIN AND DIELDRIN

PART VI - GENERAL

6.1 Although aldrin and dieldrin formulations have been available in the United States of America for a considerable time, the insecticides have only recently become available in Southern and East Africa. It will be obvious to all that new insecticides cannot be placed on the market in any country without an examination of their efficacy against local species of insects.

6.2 Any purchaser who uses the insecticides for the attempted control of an insect with which no preliminary tests have been carried out, will be disappointed should aldrin or dieldrin fail to give the results desired. As indicated in 4.1, these new insecticides are not "cure alls", and they have their limitations. It is with the object of defining these limitations, and of being able, confidently, to recommend their use in other applications, that a comprehensive experimental programme is being continued.

6.3 Owing to difficulties of import, limited quantities only of aldrin and dieldrin formulations are available from stock, and there may be cases where, through no fault of our own, we shall be unable to supply. Nevertheless, if substantial quantities are required, we should be glad if interested persons would discuss the matter with us or with our branches so that, if it is possible, arrangements can be made to import.

6.4 As indicated in section 2.3, we hope that, in the near future, formulations will be made locally. This does not necessarily mean that such formulations would be manufactured by ourselves. Insecticide distributors and manufacturers who are interested in adding aldrin and dieldrin formulations to their range, are invited to contact us, and we should be glad to discuss formulations, manufacturing methods, etc.

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